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## A decade of Portuguese research in e-government: evolution, current standing, and ways forward

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Gonçalo Paiva Dias

School of Technology and Management of Águeda (ESTGA),  
Research Unit for Governance, Competitiveness and  
Public Policies (GOVCOPP),  
University of Aveiro,  
Apartado 473, 3754 – 909, Águeda, Portugal  
Email: [gpd@ua.pt](mailto:gpd@ua.pt)

**Abstract:** In this paper, we present an investigation of the Portuguese research on e-government. Bibliometric techniques are used to explore all the documents published by researchers affiliated to Portuguese institutions from 2005 to 2014 and listed in the Scopus® database. Research production, impact, source types, language used, subject areas, topics, scopes, methods, authors, institutions, networks, and international cooperation are analysed and discussed. We conclude that so that Portuguese research on e-government can evolve, more researchers should be involved, international cooperation should be developed, and more attention should be given to the study of the reasons behind the very good results of the country in the provision of e-government services, as measured by the international rankings. By establishing the evolution and current standing of e-government research in Portugal and exploring the ways forward, our conclusions may prove useful to e-government researchers, research managers, and research policy makers.

**Keywords:** e-government; bibliometrics; Portugal; research; content analysis; co-authorship analysis.

**Reference** to this paper should be made as follows: Dias, G.P. (2016) 'A decade of Portuguese research in e-government: evolution, current standing, and ways forward', *Electronic Government, An International Journal*, Vol. 12, No. 3, pp.201–222.

**Biographical notes:** Gonçalo Paiva Dias holds a PhD in Computer Engineering. He is currently a Vice-Rector at the University of Aveiro and a Researcher at the Research Unit for Governance, Competitiveness and Public Policies. He is a Member of the Editorial Board of the *Iberian Journal of Information Systems and Technologies (RISTI)*, the International Editorial Review Board of the *International Journal of Electronic Government Research (IJEGR)*, the Coordinating Committee of the *Iberian Conference on Information Systems and Technologies (CISTI)*, and the Program Committee of the *World Conference on Information Systems and Technologies (WorldCIST)*. He has more than 50 internationally published papers on the subjects of e-government, information systems and technologies, and higher education.

This paper is a revised and expanded version of a paper entitled 'Bibliometric analysis of Portuguese research in e-government' presented at *CENTERIS 2014 – Conference on ENTERprise Information Systems*, Troia, Lisbon, Portugal, 15–17 October, 2014.

## 1 Introduction

In 2014, Portugal was ranked 37 out of 193 countries in the United Nations (UN) e-Government Development Index (UN, 2014). In the same year, in the European Commission e-government survey (Tinhol et al., 2014), Portugal was ranked 2 out of the 28 European Union (EU) member countries, plus Switzerland, Iceland, Norway, Republic of Serbia, and Turkey regarding ‘user centric government across life events for citizen and business life events’ (indicates to what extent a service is provided online and how this is perceived), and 3 out of the same 33 countries regarding ‘transparency across life events’ (indicates to what extent governments are transparent as regards their own responsibilities and performance, the process of service delivery and personal data involved). These rankings show that Portugal has a comfortable position to what concerns e-government development, and very good positions to what concerns availability and use of online public services and transparency in their provision. Since April 2015 Portugal has hosted the headquarters of the Operating Unit on Policy-Driven Electronic Governance of the United Nations University (UNU-EGOV). More detailed descriptions of what has been accomplished in the country in terms of e-government development can be found, for example, in reports produced by the OECD (2008) and the European Commission (2015).

Given these facts, it seems interesting to study to what extent e-government research in the country matches its success regarding the deploying and use of e-government services and international visibility of its achievements. In a preliminary comparative study performed in 2014, evidence was collected that that may not be the case (Dias, 2014). The present paper updates and extends that study. It addresses the development and current standing of Portugal relating to e-government research by using international research indexes as a source and bibliometrics as a technique. Specifically, research production, research impact, publication source types, language used, subject areas, studied topics, addressed scopes, methods used, most productive and impacting authors, most relevant research institutions, co-authorship networks, and international cooperation are analysed and discussed. Our conclusions may prove useful to researchers in the area of e-government, and to research managers and research policy makers in Portugal. They may also prove useful to researchers in other countries as a reference for benchmark.

The author of this paper is an active researcher in the field of e-government in Portugal. Thus, it is unavoidable that its own contributions are included in the object of the study. Nevertheless, the fact that the study is based entirely on third-party data guarantees an independent base ground, and especial care was taken in the interpretation of data to avoid any biased albeit unintended analysis.

The remaining of this paper is organised as follows: in Section 2, we introduce bibliometrics and resume the literature on e-government bibliometrics; in Section 3, we present the methods used in the study; in Section 4, we present the results; in Section 5, we discuss those results; and in Section 6, we present the general conclusions, its implications, and future work.

## 2 Literature review

When applied to academic publications, bibliometrics can be defined as dealing with the quantitative analysis of scientific and technological literature (de Bellis, 2009).

It encompasses a set of methods that allow the study of scientific production (e.g., number of publications), research impact (e.g., number of citations, average citations per paper, *h*-index), and scientific collaboration (e.g., co-authorship analysis). Although these methods are widely used to study research in various fields, they have been scarcely used to study e-government research.

Examples of the use of bibliometrics to study e-government research include fewer than a dozen papers and conference papers. Dwivedi (2009b) performed an analysis of e-government research published in *Transforming Government: People, Process and Policy* from 2007 to 2008. He used a profiling approach to examine variables such as the most productive authors, the most productive universities, geographic diversity, authors' backgrounds, co-authorship, and research methods. He found that analytical, descriptive, theoretical and conceptual methods were the most dominant research approaches utilised by the authors of the 41 papers analysed, and that the largest number of contributions came from authors with an information systems background, followed by business and computer science and IT. Also in 2009, the same author published a bibliometric analysis of e-government research based on 1,037 papers published in 19 peer reviewed journals. Variables such as subject category, publication year, most active authors, most active institutions, most representative countries, and language used were studied. The analysis of the research methods used and the topics addressed were identified as needed in order to provide greater understanding of e-government research (Dwivedi, 2009a).

Erman and Todorovski (2009) published a first study of the most influent authors and relate them to the thematic topics that prevailed in the EGOV conference between 2005 and 2008. Social network analysis was used as a methodology. The same approach was used in a paper published by the same authors in 2010 (Erman and Todorovski, 2010). In 2011, they published a third study comparing the collaborative networks of co-authorship relationships between scholars that published at the European Conference on eGovernment (ECEG), and the International Conference on eGovernment (ICEG), between 2005 and 2008 (Erman and Todorovski, 2011). Results showed that each conference had its own stable community to what concerns collaboration, thus indicating that a joint e-government scientific community did not exist at that time.

Cheng and Ding (2012) conducted a quantitative analysis on 2,232 papers listed in the *Social Sciences Citation Index* (SCI journals). They identified the 20 most productive authors and the top 20 highly cited and pivotal documents in the e-government research field. They found that the "hotspots in the research of electronic government included the enhance e-government cross-sectoral collaboration ability, the construction of e-government", and "the security infrastructure design of digital government in a multiple and complex environment".

Joseph (2013) performed a bibliometric analysis on e-government research to examine variables such as research methods used, region of study, area of focus, and authors. He concluded that almost 50% of e-government studies are either conceptual or rely solely on secondary data sources for analysis, that Europe, North America and Asia provided the primary focus of the analysed research, and that there was no specific topic dominating e-government research.

More recently Almeida et al. (2014) performed a bibliometric study on e-government academic production using ISI Web of Science™ as a source. Using data from 4,225 records (including papers in journals and conference proceedings) they have found that nearly 80% of the citations were concentrated in the 10 most cited countries, and that the publication of papers in reputable journals was pivotal for these results. In the same year

but using Google Scholar as a source for data, Ismayilova (2014) performed a bibliometric analysis of 381 e-government materials published between 2000 and 2014. Research topics, international collaboration, and the most productive countries, authors and organisations were studied. She concluded that most researched areas are e-government technological and development issues and e-government applications. The most productive authors of e-government research are affiliated to the best institutes of USA, Singapore and UK.

Finally, Przybilovicz et al. (2014) conducted a bibliometric and sociometric study by analysing 124 papers published in Brazilian journals and conference proceedings from 2007 to 2012. Number of publications per year, location of the publications, conceptual and substantive domains of study, methodological approaches, and cooperation networks were analysed. They concluded that Brazilian authors have few connections and little interaction with each other and that most studies were published at events rather than in journals. They identified the needs for greater interaction between Brazilian researchers in the field, the use of theories on which to base arguments and findings, and greater efforts to publish papers in high-level international journals.

From the above literature review it is evident that previous bibliometric studies on e-government research vary on their scope (international, specific research communities, a single country), the sources used (selected conferences, selected journals, general research databases), and variables that are studied. Concerning the latter, the most common are the analysis of the most productive and cited authors, institutions, and countries, and of research topics, research methods, and collaboration networks. Others include authors' backgrounds, the most relevant papers, the most relevant journals, language used, and scopes of studies.

### 3 Methodology

The set of documents analysed in this study was retrieved using the Scopus® database as a source. Scopus® was used because it retrieved more entries for the intended search conditions than other sources, namely ISI Web of Science™, thus implying a bigger sample. Moreover, the high correlation of measures taken using both databases, at least to what concerns the number of papers and the number of citations received by countries, including when broken down by subject area (Archambault et al., 2009), was also relevant to this choice. The fact that the Portuguese Foundation for Science and Technology (FCT) has recently used Scopus® to perform the 2013 bibliometrics analysis of the Portuguese research units and associated laboratories was another relevant reason. Another advantage of Scopus® is that, unlike ISI Web of Science™, it includes some additional journals that are relevant to the subject, for example, *Electronic Government* and *International Journal of Electronic Government Research*.

Although the sensitivity of the specific measures taken in this study to the use of the two databases was not directly addressed, it is worth mentioning that, using the year 2013 as an example and for similar search conditions (see below), 75% of the documents returned by ISI Web of Science™ are also returned by Scopus®, while 60% of the documents returned by Scopus® are also returned by ISI Web of Science™. The use of alternative data sources was not considered because they offered a lower coverage or because they included documents (and citations from documents) that are not subject to

scientific revision (e.g., Google Scholar). Also, the combination of different sources is impracticable because of the different bases used to compute citations.

The set of documents used in the study was retrieved on the 2nd of May, 2015 using the online search engine of the database. Citation data was downloaded on the 27th of December, 2015 and included all citations obtained till the end of 2014 to the previously retrieved documents. The search conditions included all documents having the expressions ‘e-government’, ‘e-gov’, ‘egovernment’, ‘egov’ or ‘digital government’ in their title, abstract or keywords in which ‘Portugal’ is affiliation country, in a 10 year window, starting in 2005 (see expression 1).

The used search conditions were carefully selected. The expression ‘electronic government’, in particular, was not included because it was verified that it was essentially redundant with the other. To some extent, the same was true for other expressions related to e-government such as ‘digital democracy’ or ‘electronic governance’. Even so, it cannot be excluded that some papers might have been affected by this choice. Note, however, that the inclusion of keywords in the search expression (both author and generated keywords) tends to minimise this possibility since papers related to e-government are usually indexed using the ‘e-government’ keyword, either by their authors or for indexation purposes.

```
(TITLE-ABS-KEY({e-government}) OR TITLE-ABS-KEY({e-gov}) OR  
TITLE-ABS-KEY(egovernment) OR TITLE-ABS-KEY(egov) OR  
TITLE-ABS-KEY({digital government})) AND AFFILCOUNTRY(portugal)  
AND PUBYEAR > 2004 AND PUBYEAR < 2015
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(1)

The resulting set was analysed for correction and one paper was subsequently excluded because it respected to a duplicate entry in the database. The final set includes 69 documents.

A bibliometric analysis was then performed in the final set. The following items were analysed:

- number of published documents per year, source type, subject areas, and language used
- number of citations per year
- number of papers per author and affiliation institution
- number of citations per author and affiliation institution
- global and per author and per affiliation average citations by document and *h*-index<sup>1</sup>
- per author percentage of published documents on e-government among all published documents
- number of documents co-authored with researchers affiliated to foreign institutions and corresponding citations, average citations and *h*-index.

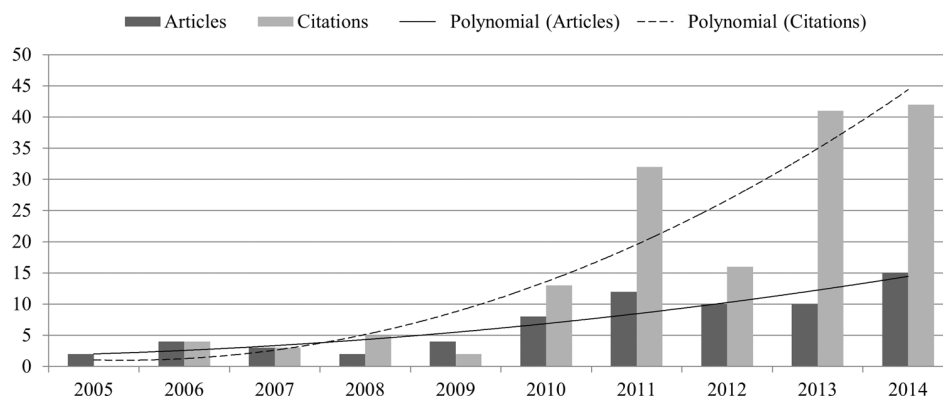
A co-authorship analysis was then performed to identify the most productive research networks and the relevance of international cooperation in those networks, considering the most productive authors as seed nodes for the identification of networks.

The paper abstracts were subsequently analysed concerning their scope, the e-government topics addressed, and the methods used, if any. To this purpose, a conceptual analysis (a subcategory of content analysis) was performed. The categories were comprehensively established during the analysis, taking into consideration the descriptions presented.

## 4 Results

Figure 1 depicts the evolution of papers published and citations received by researchers affiliated to Portuguese institutions between 2005 and 2014. During this period, there were 158 citations to the 69 documents in the dataset. Despite the small numbers, it is noticeable a growing trend in both variables. Further results are presented in the following subsections.

**Figure 1** Evolution of documents published and citations received by researchers affiliated to Portuguese institutions indexed in the Scopus® database, between 2005 and 2014. Second order polynomial curves are also represented for papers and citations (with  $R^2 = 0.8492$  and  $R^2 = 0.8506$ , respectively)



### 4.1 Source types and language

From the set of 69 papers selected, 17 are journal papers, 48 are conference papers (40 published in conference proceedings and 8 in book series) and four are book chapters. Table 1 illustrates the number of documents, number of citations and average citations per document for the three different types of publication sources (journals, conference proceedings and books). As can be observed, average citations are higher for documents published in journals than for those published in conference proceedings or books.

**Table 1** Number of papers, number of citations, and average citations per paper by source type, between 2005 and 2014

Source type	Documents	Citations	Average citations
Journals	17	90	5.29
Conference proceedings	40	58	1.45
Books	12	10	0.83

As far as the impact of journals in citations is concerned, Table 2 lists the number of documents, the number of citations and the average citations by the best quartile of the journal according to its SJR classification.<sup>2</sup> It is visible that with the exception of the fourth quartile, the average citations per paper are always higher for greater impact quartiles. With respect to the fourth quartile it is worth mentioning that all the citations in this quartile are for papers published in the Iberian Journal of Information Systems and Technologies (three papers, 15 citations), a journal that publishes papers only in Portuguese and Spanish.

**Table 2** Number of papers, number of citations, and average citations per paper by quartile of the source journal (*JCR*), between 2005 and 2014

<i>Journal quartile</i>	<i>Documents</i>	<i>Citations</i>	<i>Average citations</i>
Q1	2	43	21.50
Q2	5	28	5.60
Q3	5	10	2.00
Q4	4	15	3.75

There is no information on the 2014 quartile or one journal with one paper published.

Concerning the language used, 56 documents were originally published in English and 13 in Portuguese. Documents published in English have an average citation of 2.45 whereas documents written in Portuguese have an average citation of 1.62.

#### 4.2 Subject areas

In the Scopus® database documents are classified as pertaining to one or more subject areas. Within the 69 documents of the set, the more relevant subject areas are Computer Science (83% of the documents listed), Social Sciences (17%), Business, Management and Accounting (17%), and Engineering (10%).

As a document can be classified in more than one subject area, the direct analysis of average citation by Scopus® subject areas can lead to misinterpretations. To avoid this problem, Table 3 presents data based on derived broader and nonoverlapping subject areas: 'computer science and engineering'; 'social sciences and business, management and accounting', and 'transversal to both areas'. Figures for number of documents, number of citations and average citations are presented. It is evident from the table that while the majority of the publications were made in the 'computer science and engineering' subject area, the documents classified as 'transversal to both areas' had the greatest average impact. In fact, this result is coherent with the transdisciplinary nature of e-government research.

**Table 3** Number of papers, number of citations, and average citations per paper by subject area, between 2005 and 2014

<i>Broad and nonoverlapping subject area</i>	<i>Documents</i>	<i>Citations</i>	<i>Average citations</i>
Computer science and engineering	47	68	1.45
Social sciences and business, management and accounting	10	17	1.70
Transversal to both areas	12	73	6.08

### 4.3 Topics addressed

Table 4 presents the results of the conceptual analysis for topic categories. Regarding the analysis, 77% of the documents fall into one of the eight most representative categories: ‘interoperability and service integration’; ‘strategies and methodologies’; ‘quality, accessibility and usability’; ‘back-office processes, workflows, and knowledge/data management’; ‘marketing, transparency and public participation’; ‘administrative and socioeconomic impacts’; ‘key development and adoption factors’; and ‘privacy and security’. Thus, there is good topic coverage, including several relevant e-government concerns: strategies and methodologies for –government, key factors, quality of what is offered to citizens, citizens’ involvement and participation, e-government impacts, interoperability, back-office processes, and security.

**Table 4** Frequency and percentage of topics categories addressed by the selected documents

<i>Topic category</i>	<i>Frequency</i>	<i>Percentage (%)</i>	<i>Documents</i>
Interoperability and service integration	13	19	(Campos and Soares, 2014; Dias and Narciso, 2010; do Nascimento et al., 2005; Gomes et al., 2011, 2012; Gomes and Ribeiro, 2009; Janssen et al., 2014; Marques et al., 2011, 2012, 2013; Sá and Rocha, 2012; Soares and Amaral, 2011; Tsaravas and Themistocleous, 2011)
Strategies and methodologies	9	13	(Aveiro and Pinto, 2013; Conceição et al., 2013; Costa et al., 2010; Pinto and Aveiro, 2014; Rocha and Sá, 2014; Rodousakis and dos Santos, 2008; Sá and Rocha, 2012, 2013; Sanz et al., 2010)
Quality, accessibility and usability	9	13	(Aleixo et al., 2012; Luján-Mora and Masri, 2012; Polónia et al., 2014; Ribeiro, 2011; Rodrigues et al., 2010b; Sá et al., 2014a, 2014b; Sanz et al., 2010; Silva et al., 2006)
Back-office processes, workflows, and knowledge/data management	7	10	(Afonso et al., 2014; Becker et al., 2011; do Nascimento et al., 2005; Rodrigues et al., 2010b; Tavares, 2008; Teixeira et al., 2014; Vieira et al., 2011)
Marketing, transparency, and public participation	7	10	(Irani et al., 2010; Lapão et al., 2007; Lourenço et al., 2014; Maciel et al., 2009a, 2009b; Maciel et al., 2010; Tavares and Silva, 2006)
Administrative and socioeconomic impacts	4	6	(Domingues and Gomes, 2011; Fernandes, 2013; Santos et al., 2013; Silva et al., 2012)
Key development and adoption factors	4	6	(Dias and Costa, 2013; Freire et al., 2014; Rosa et al., 2013; Tavares and Oliveira, 2014)



**Table 4** Frequency and percentage of topics categories addressed by the selected documents (continued)

<i>Topic category</i>	<i>Frequency</i>	<i>Percentage (%)</i>	<i>Documents</i>
Privacy and security	4	6	(Dias, 2011b; Filho and Ribeiro, 2014; Gaaloul et al., 2014; Teodoro and Serrão, 2010)
E-learning environments	3	4	(Fernandes et al., 2012; Pedrosa et al., 2013; Silva et al., 2012)
Maturity models and maturity assessment	3	4	(Conceição et al., 2013; Dias et al., 2013; Dias, 2011a)
Mobile government	3	4	(Machado et al., 2005; Olmstead et al., 2007; Pascoe et al., 2006)

#### 4.4 Addressed scopes

Concerning the scope of the documents, 55% are of general application (i.e., not addressing a specific level or branch of government) and 32% relate to local e-government (see Table 5). Specific branches of government are addressed by only 9% of the papers. It is interesting to notice that local e-government receives a significant research attention even though, contrary to what happens with e-government in general, local e-government is substantially underdeveloped in Portugal (Dias, 2011a; Dias and Gomes, 2014).

**Table 5** Frequency and percentage of scope categories addressed by the selected documents

<i>Scope category</i>	<i>Frequency</i>	<i>Percentage (%)</i>	<i>Documents</i>
General	38	55	(Becker et al., 2011; Campos and Soares, 2014; Campos and Marques, 2006; Conceição et al., 2013; Costa et al., 2010; Dias et al., 2013; Dias and Rafael, 2007; Domingues and Gomes, 2011; Fernandes et al., 2012; Fernandes, 2013; Filho and Ribeiro, 2014; Freire et al., 2014; Gomes et al., 2011, 2012; Irani et al., 2010; Janssen et al., 2014; Katre et al., 2011; Lourenço et al., 2014; Luján-Mora and Masri, 2012; Machado et al., 2005; Maciel et al., 2009a, 2009b, 2010; Marques et al., 2011, 2012, 2013; Montargil, 2009; Olmstead et al., 2007; Pascoe et al., 2006; Ribeiro, 2011; Rodousakis and dos Santos, 2008; Rodrigues et al., 2010a; Silva et al., 2006; Soares and Amaral, 2011; Tavares and Silva, 2006; Teodoro and Serrão, 2010; Tsaravas and Themistocleous, 2011; Vieira et al., 2011)
Local government	22	32	(Afonso et al., 2012, 2014; Aleixo et al., 2011, 2012; Aveiro and Pinto, 2013; Dias and Costa, 2013; Dias and Gomes, 2014; Dias and Narciso, 2010; Dias, 2011a, 2011b; Gomes and Ribeiro, 2009; Rocha and Sá, 2014; Rodrigues et al., 2010b; Sá et al., 2014a, 2014b; Sá and Rocha, 2012, 2013; Santos et al., 2013; Sanz et al., 2010; Silva et al., 2012; Tavares, 2008; Teixeira et al., 2014)

**Table 5** Frequency and percentage of scope categories addressed by the selected documents (continued)

<i>Scope category</i>	<i>Frequency</i>	<i>Percentage (%)</i>	<i>Documents</i>
Judicial system	3	4	(do Nascimento et al., 2005; Gaaloul et al., 2014; Rosa et al., 2013)
Healthcare	2	3	(Lapão et al., 2007; Tavares and Oliveira, 2014)
Regional government	2	3	(Pinto and Aveiro, 2014; Polónia et al., 2014)
Tax administration	2	3	(Pedrosa et al., 2013; Silva et al., 2012)

#### 4.5 Methods used

With regard to the methods used, 43% of the papers present new models, systems or methods proposals; 19% are based on case studies; and 9% are based on content analysis, mainly of governmental websites (see Table 6). Other relevant categories include bibliographic reviews and surveys. It is worth noting the significant weight of documents that propose new models, systems or methods when compared with the number of studies based on empirical data.

**Table 6** Frequency and percentage of main method categories used by the selected documents

<i>Main method category</i>	<i>Frequency</i>	<i>Percentage (%)</i>	<i>Documents</i>
New model or system proposal	25	36	(Campos and Soares, 2014; Costa et al., 2010; Dias and Rafael, 2007; do Nascimento et al., 2005; Filho and Ribeiro, 2014; Gaaloul et al., 2014; Gomes et al., 2011, 2012; Gomes and Ribeiro, 2009; Irani et al., 2010; Luján-Mora and Masri, 2012; Maciel et al., 2009a; Marques et al., 2011, 2012, 2013; Olmstead et al., 2007; Pedrosa et al., 2013; Rodrigues et al., 2010a; Sanz et al., 2010; Silva et al., 2012; Tavares and Oliveira, 2014; Tavares, 2008; Tavares and Silva, 2006; Teixeira et al., 2014; Vieira et al., 2011)
Case study	13	19	(Aveiro and Pinto, 2013; Becker et al., 2011; Dias and Narciso, 2010; Maciel et al., 2009b, 2010; Pinto and Aveiro, 2014; Rocha and Sá, 2014; Rosa et al., 2013; Sá and Rocha, 2012, 2013; Santos et al., 2013; Silva et al., 2012; Tsaravas and Themistocleous, 2011)
Content analysis	9	13	(Aleixo et al., 2012; Dias and Costa, 2013; Dias and Gomes, 2014; Dias, 2011a, 2011b; Lourenço et al., 2014; Ribeiro, 2011; Sanz et al., 2010; Silva et al., 2006)

**Table 6** Frequency and percentage of main method categories used by the selected documents (continued)

<i>Main method category</i>	<i>Frequency</i>	<i>Percentage (%)</i>	<i>Documents</i>
New method proposal	5	7	(Conceição et al., 2013; Janssen et al., 2014; Machado et al., 2005; Polónia et al., 2014; Tsaravas and Themistocleous, 2011)
Bibliographic review	5	7	(Campos and Marques, 2006; Freire et al., 2014; Montargil, 2009; Sá et al., 2014a, 2014b)
Employees or experts survey	3	4	(Afonso et al., 2014; Rodrigues et al., 2010b; Soares and Amaral, 2011)

#### 4.6 Research institutions

Table 7 presents data concerning the research institutions to which the authors of the selected papers are affiliated. Only Portuguese institutions to which three or more papers are affiliated are presented. The University of Aveiro, *per se*, is responsible for 26% (18 out of 69) of the published documents and 50% (79 out of 158) of the citations. The University of Minho received 18% of the citations. Altogether, these two universities represent 36% of the papers published and 68% of the citations. Only three universities have *h*-index of 2 or bigger: Aveiro, Minho and Coimbra (4, 2, and 2, respectively). They are also the three research institutions with higher average citations per paper (4.39, 4.00, and 1.43, respectively).

**Table 7** Number of papers, number of citations, average citations per paper, and *h*-index per affiliation institution with more than three papers published between 2005 and 2014

<i>Affiliation</i>	<i>Papers</i>	<i>Citations</i>	<i>Average citations</i>	<i>h-index</i>
Universidade de Aveiro	18	79	4.39	4
Universidade de Lisboa	8	6	0.75	1
Universidade do Minho	7	28	4.00	2
Universidade de Coimbra	7	10	1.43	2
Universidade do Porto	3	2	0.67	1
Universidade do Algarve	3	0	0.00	0

#### 4.7 Authors

Table 8 presents data concerning the authors that published documents affiliated to Portuguese institution between 2005 and 2014. Only authors affiliated to Portuguese institutions with three or more papers published are presented. The first relevant

observation is that only seven authors have at least three papers published. From those, only two have more than 10 citations (Dias, G.P. and Zúquete, A.). In fact, in the dataset there are only two papers with 10 or more citations (Dias and Rafael, 2007; Machado et al., 2005), one of them pertaining to authors with less than three documents in the dataset. These two documents, *per se*, received 37% of the citations to all documents. The authors represented in Table 8 (with three or more documents) received 56% of those citations.

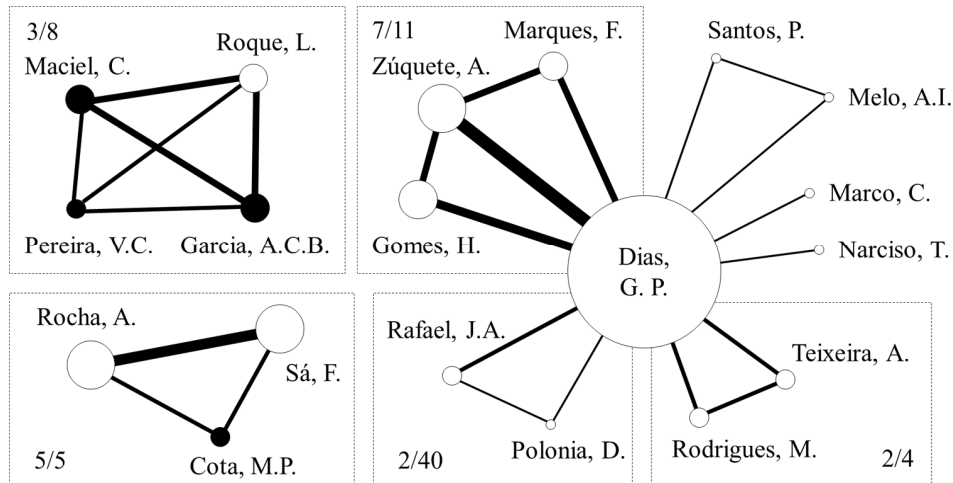
**Table 8** Number of documents, number of citations, average citations per paper, and *h*-index per author with Portuguese affiliation and more than three papers published between 2005 and 2014

<i>Author</i>	<i>Documents</i>	<i>Citations</i>	<i>Average citations</i>	<i>h-index</i>
Dias, G.P.	16	75	4.69	4
Zúquete, A.	6	11	1.83	2
Rocha, A.	5	5	1.00	1
Sá, F.	5	5	1.00	1
Gomes, H.	4	6	1.50	2
Roque, L.	3	8	2.67	1
Marques, F.	3	5	1.67	2

It is also worth mentioning that six out of the seven authors with three or more papers published belong to only two co-authorship networks, as shown in Figure 2. In the Figure, authors are represented by circles and co-authorship relations by lines linking those circles. The diameter of each circle is proportional to the number of papers published by the corresponding author and the thickness of each line is proportional to the number of documents co-authored by the authors linked by that line. Co-authorship networks with two or more documents published are contained in dotted rectangles. As can be observed there are only five of those co-authorship networks. Those involve all authors listed in the Table 8. Together, these five networks represent 28% of the publications and 43% of the citation in the dataset.

Another aspect which needs attention is to what extent e-government is, for the more productive and cited authors, their main research interest. As it can be observed in Table 9, only four authors have published more than one quarter of their publications in the subject of e-government. Among them is the most productive and cited Portuguese author in e-government (Dias, G.P.), who, however, is only the fourth author in the table with more publications when all publications are considered. Two other authors in this list have co-authored all their e-government documents with Dias, G.P. and the remaining author (Sá, F.) has only five papers published on e-government (for a total of 7), all in co-authorship with the most productive author, when all papers are considered (Rocha, A.). At a more general level it is also very relevant to notice that computer science is the main subject area of publication for all authors listed in Table 9 (meaning that the majority of the papers they published are classified in that subject area, even though part of them may also be classified in other areas).

**Figure 2** Co-authorship graph: representation of the co-authorship networks of the authors affiliated to Portuguese institutions with three or more documents in the dataset. Main five collaboration networks are represented, with mention to the number of documents published and number of citation received within each network (documents/citations). Author affiliated to foreign institution are represented with black circles



**Table 9** Number of e-government documents, number of all documents, and percentage of e-government documents over all documents per author with three or more e-government documents published between 2005 and 2014

<i>Author</i>	<i>e-government documents</i>	<i>All author documents</i>	<i>Relative importance of e-government (%)</i>	<i>Relative importance of computer science (%)</i>
Rocha, A.	5	65	8	94
Zúquete, A.	5	48	10	91
Roque, L.	3	33	9	84
Dias, G.P.	16	21	76	90
Gomes, H.	4	11	36	90
Marques, F.	3	11	27	100
Sá, F.	5	7	71	71

#### 4.8 International cooperation

Concerning international cooperation, researchers affiliated to 24 institutions in 17 foreign countries are co-authors of documents included in the dataset, involving 21 documents (30% of the total) with 31 citations (20% of the total). Table 10 resumes the number of documents in the dataset that were co-authored with authors affiliated to institutions in the most relevant foreign countries: Spain; UK; Brazil; Germany; and Austria. In all cases *h*-index is less than or equal to two, expressing the relative low relevance of each country to what respects research cooperation with Portuguese researchers in the e-government subject.

With reference to Figure 2, it can be observed that three out of the five main co-authorship networks are solely composed of researchers affiliated to Portuguese

institutions (those involving Dias, G.P.), one includes three Brazilian authors (co-authors with Roque, L.), and the other includes a Spanish researcher (Cota, M.P.).

**Table 10** Number of documents co-authored with authors affiliated to institutions in the more relevant foreign countries (two or more documents co-authored) and corresponding number of citations, average citations per paper, and *h*-index

<i>Country</i>	<i>Documents</i>	<i>Citations</i>	<i>Average citations</i>	<i>h-index</i>
Spain	7	4	0.57	2
UK	3	11	3.67	2
Brazil	3	8	2.67	1
Germany	2	8	4.00	2
Austria	2	6	3.00	1

## 5 Discussions

From the presented results, it seems obvious that the production and international visibility of Portuguese research in e-government can still be greatly improved. Two evidences corroborate this conclusion: only seven authors pertaining to only three co-authorship networks have three or more papers listed in the Scopus® database in the subject; and only two papers, two authors and two institutions have received more than 10 citations.

It seems also evident that this may be the consequence of the relatively small number of researchers dedicated to the study of e-government in Portugal: from the set of seven researchers with three or more documents published, only four dedicated more than one quarter of their total publications to the subject. Also, these authors are involved in only five relevant co-authorship networks of which three involve the most productive and cited Portuguese researcher in the subject. Moreover, the seven more productive authors concentrate 35% of the publications and 56% of the citations received and one of those authors, alone, contributed to 23% of the publications and 47% of the citations received.

Besides the relative small number of researchers involved, the volume and quality of the international cooperation on the subject might be another reason for the low visibility of the published research. Indeed, although 30% of the published documents were co-authored internationally, those received only 20% of the citations. Also, there are only five foreign countries with two or more documents co-authored with Portuguese researchers. Finally, the most productive and cited Portuguese researcher has no documents co-authored internationally in the subject.

Another reason for the low visibility of the produced research is that the majority of the documents were published in conference proceedings or low impact journals. In addition, 19% of the papers were written in Portuguese, which obtained a lower average citation per document than those written in English.

Although the list of research topics is diversified, a significant number of documents (43%) relate to the presentation of new models, systems or methods proposals without evidence that those proposals have directly contributed to the development of e-government in Portugal. On the other hand, it seems that more effort could be dedicated to assess the reasons that foster the good results of the country concerning online public

services provision. Other evidence is that local e-government is the focus of 32% of the papers published, when it is recognised that local e-government is substantially undeveloped in Portugal when compared to central government. This might also be caused by the fact that all the most productive and cited researchers have computer science publication profiles.

The study presented in this paper is based on a bibliometric analysis of journal papers, conference papers and book chapters listed in the Scopus® database and authored by researchers affiliated to Portuguese institutions. This approach has some limitations. In fact, it can be argued that the Scopus® database does not represent all e-government research conducted in Portugal in the past 10 years, both because it does not include all published papers and because it does not include other relevant contributions like master and PhD thesis or funded research projects. Nevertheless, it can also be argued that it would be natural that those other contributions, once published, should be visible internationally through research indexes like Scopus®. Despite these limitations, it is our conviction that this source is sufficiently representative to support the conclusions presented in this paper and that no substantially different conclusions could be achieved using different sources of information.

## **6 Conclusions and future work**

In this paper we presented a bibliometric analysis of documents published internationally by researchers affiliated to Portuguese institutions in the subject of e-government between 2005 and 2014. The Scopus® database was used as a source.

Since 2005 the number of documents on e-government published by researchers affiliated to Portuguese institutions and listed in the Scopus® database and the number of citation received by those documents has grown consistently. The number of researchers who published results on e-government has also grown steadily. Despite this development, there is still substantial room for improvement with regard to the investigation of the subject in Portugal. This is evident from the analysis of the research production which was published internationally and its achieved visibility. Indeed, some shortcomings need to be overcome so that this development can continue to happen sustainably.

First, there is the need to involve more researchers and research institutions, and from other areas than computer science. To accomplish this, besides raising awareness for the importance of e-government research, it is important to adapt national research funding mechanism, so that transdisciplinary research projects can have best chances to be financed. In addition, it is important that universities and other research institution create the condition for the establishment and development of transdisciplinary research teams that include the multiple valences which are needed to conduct comprehensive studies on e-government.

Second, efforts must be made to develop international cooperation and to publish results in English and in higher impact journals. This can be fostered by increasing the participation in international networks devoted to the subject, notably at the European level, thereby also enhancing the participation in internationally funded projects. A natural consequence will be that more papers, and with a greater potential for impact will be co-authored with researchers from other countries.

Third, there is the opportunity to expand the range of topics studied, the scope of those studies, and the methods used to perform them. In particular, more attention should be given to the study of the reasons that explain the good results of the country in e-government development as measured by international rankings and to use the results of research to further promote this development. To accomplish this, an important course of action is to raise awareness of Portuguese researchers to the asymmetry of the results of the country in terms of e-government development and of e-government research. In the other direction, it would be also important that the authorities in charge for the development of e-government in Portugal seek a greater involvement of the Portuguese research institutions in their efforts, including in the design of the actions undertaken and the study of their impact and success factors.

We believe that the present study will be of use to accomplish these objectives. Indeed, our conclusions might prove useful for researchers interested in the subject as well as to research managers and policy makers at the central and local governments, at the agencies in charge of e-government development and at the several universities and other research centres.

The study presented in this paper could be extended by including data from additional sources, namely from other national and international repositories, and by extending its scope to master and PhD thesis produced and the participation in e-government research projects, for example. This could allow detecting if the low international visibility of e-government research in Portugal is only due to the limited number of researchers and institutions involved in the subject, low international cooperation, and topics addressed, as we have concluded, or also because some other difficulties in achieving international visibility to the research produced exist.

A future research opportunity that arises from this study is to what extent our conclusions may be valid for other countries which, such as Portugal, are not among the most productive and impacting in e-government research. To this respect, it is interesting to notice that some of our diagnoses and conclusions are similar to the ones presented by Przybilovicz et al. (2014) for the Brazilian case.

## References

- Afonso, C., de la Gonzalez, M., Roldán, J. and Sánchez-Franco, M. (2012) 'Determinants of user acceptance of a local eGovernment Electronic Document Management System (EDMS)' *Proceedings of the European Conference on e-Government (ECEG 2012)*, Barcelona, Spain, pp.19–28.
- Afonso, C.M., Schwarz, A., Roldán, J.L. and Sánchez-Franco, M.J. (2014) 'EDMS use in local e-government: extent of use and overall performance mediated by routinization and infusion', *Proceedings of the 20th Americas Conference on Information Systems (AMCIS 2014)*, Savannah, GA, USA.
- Aleixo, C., Nunes, M. and Isaías, P. (2012) 'Usability and digital inclusion: standards and guidelines', *International Journal of Public Administration*, Vol. 35, No. 3, pp.221–239.
- Aleixo, C., Nunes, M.B. and Isaías, P. (2011) 'Digital divide: a study on Portuguese municipalities' web sites', *Proceedings of the IADIS International Conference ICT, Society and Human Beings 2011*, Rome, Italy, pp.125–132.
- Almeida, G.O., Zouain, D.M. and Mahecha, Y.L.R. (2014) 'The status of e-government research: a bibliometric study', *Business and Management Review*, Vol. 3, No. 11, pp.7–22.



- Archambault, É., Campbell, D., Gingras, Y. and Larivière, V. (2009) 'Comparing bibliometric statistics obtained from the web of science and Scopus', *Journal of the American Society for Information Science and Technology*, Vol. 60, pp.1320–1326.
- Aveiro, D. and Pinto, D. (2013) 'A case study based new DEMO way of working and collaborative tooling', *Proceedings of the IEEE International Conference on Business Informatics (IEEE CBI 2013)*, IEEE, Vienna, Austria, pp.21–26.
- Becker, C., Barateiro, J., Antunes, G., Borbinha, J. and Vieira, R. (2011) 'On the relevance of enterprise architecture and IT governance for digital preservation', *Electronic Government, Lecture Notes in Computer Science Series (LNCS)*, Springer, Vol. 6846, pp.332–344.
- Campos, L. and Soares, D. (2014) 'IFPortal: a web portal for the characterization and comparison of government interoperability frameworks', *International Journal of Web Portals*, Vol. 6, No. 2, pp.14–25.
- Campos, R. and Marques, C. (2006) 'E-government and public information systems in Portugal', *Proceedings of the 1st Iberian Conference on Information Systems and Technologies (CISTI 2006)*, Ofir, Portugal, Vol. 1, pp.421–437.
- Cheng, S. and Ding, L. (2012) 'A quantitative study on the research fronts of electronic government', *Proceedings of the Fifth International Conference on Business Intelligence and Financial Engineering (BIFE 2012)*, Lanzhou, Gansu, China, pp.481–485.
- Conceição, C., Costa, A., Modesto, A., Farinha, J. and Castro, T. (2013) 'E-government-towards a strong strategy: a suggested framework for UE countries', *Proceedings of the 22nd International Business Information Management Association Conference (IBIMA 2013)*, Rome, Italy, Vol. 3, pp.725–730.
- Costa, P., Vasconcelos, A. and Tribolet, J. (2010) 'SIMPLEXIS: evaluating egov measures using an information system architecture approach', *Proceedings of the 4th European Conference on Information Management and Evaluation (ECIME 2010)*, Lisbon, Portugal, pp.462–466.
- de Bellis, N. (2009) *Bibliometrics and Citation Analysis: From the Science Citation Index to Cybermetrics*, Scarecrow Press, Plymouth.
- Dias, G.P. (2011a) 'Local e-government information and service delivery', *Proceedings of the 6th Iberian Conference on Information Systems and Technologies (CISTI 2011)*, Chaves, Portugal.
- Dias, G.P. (2011b) 'Q-model: um modelo bidimensional de maturidade para o e-government', *RISTI – Revista Iberica de Sistemas e Tecnologias de Informacao*, Vol. 7, No. 1, pp.33–46.
- Dias, G.P. (2014) 'Bibliometric analysis of Portuguese research in e-government', *Procedia Technology*, Vol 16, pp.279–287.
- Dias, G.P. and Costa, M. (2013) 'Significant socio-economic factors for local e-government development in Portugal', *Electronic Government*, Vol. 10, Nos. 3–4, pp.284–309.
- Dias, G.P. and Gomes, H. (2014) 'Evolution of local e-government maturity in Portugal', *Proceedings of the 9th Iberian Conference on Information Systems and Technologies (CISTI 2009)*, Barcelona, Spain.
- Dias, G.P. and Narciso, T. (2010) 'Analysis of the potential for organizational interoperability improvement in local government', *Proceedings of the 5th Iberian Conference on Information Systems and Technologies (CISTI 2010)*, Santiago de Compostela, Spain.
- Dias, G.P. and Rafael, J.A. (2007) 'A simple model and a distributed architecture for realizing one-stop e-government', *Electronic Commerce Research and Applications*, Vol. 6, No. 1, pp.81–90.
- Dias, G.P., Gomes, H. and Zúquete, A. (2013) 'Privacy policies in web sites of Portuguese municipalities: an empirical study', in Rocha, A., Correia, A.M., Wilson, T. and Stroetmann, K.A. (Eds.): *Advances in Information Systems and Technologies, Advances in Intelligent Systems and Computing Series (AISC)*, Springer, Vol. 206, pp.87–96.
- do Nascimento, R.P.C., Martins, J.A.C. and Pinto, J.M.S. (2005) 'XML family skills used by FLoWPASS', *WSEAS Transactions on Computers*, Vol. 4, No. 6, pp.591–596.

- Domingues, L. and Gomes, J.A.C. (2011) 'Management model proposal for Portuguese public administration shared services', *Proceedings of the 2011 IEEE World Congress on Services, (SERVICES 2011)*, Washington, DC, USA, pp.25–32.
- Dwivedi, Y.K. (2009a) 'A bibliometric analysis of electronic government research', in Sahu, G.P., Dwivedi, Y.K. and Weerakkody, V. (Eds.): *E-government Development and Diffusion: Inhibitors and Facilitators of Digital Democracy*, IGI Global, London, pp.176–256.
- Dwivedi, Y.K. (2009b) 'An analysis of e-Government research published in transforming government: people, process and policy (TGPPP)', *Transforming Government: People, Process and Policy*, Vol. 3, No. 1, pp.7–15.
- Erman, N. and Todorovski, L. (2009) 'Mapping the e-government research with social network analysis', *Proceedings of the 8th International Conference on Electronic Government (EGOV 2009)*, Springer, Linz, Austria, pp.13–25.
- Erman, N. and Todorovski, L. (2010) 'Analyzing the structure of the EGOV conference community', *Electronic Government, Lecture Notes in Computer Science Series (LNCS)*, Springer, Vol. 6228, pp.73–84.
- Erman, N. and Todorovski, L. (2011) 'Collaborative network analysis of two eGovernment conferences: Are we building a community?', *Electronic Journal of E-Government*, Vol. 9, No. 2, pp.141–151.
- European Commission (2015) *E-Government in Portugal*, ISA Editorial Team, [https://joinup.ec.europa.eu/sites/default/files/egov\\_in\\_portugal\\_-\\_january\\_2015\\_-\\_v\\_17\\_0\\_final.pdf](https://joinup.ec.europa.eu/sites/default/files/egov_in_portugal_-_january_2015_-_v_17_0_final.pdf) (Accessed 30 December, 2015).
- Fernandes, S. (2013) 'An empirical approach of the distinctive aspects for socioeconomic development', *International Journal of Social Economics*, Vol. 40, No. 11, pp.956–970.
- Fernandes, S., Cerone, A. and Barbosa, L.S. (2012) 'Exploiting the FLOSS paradigm in collaborative e-learning-application to e-Government', *Proceedings of the 6th International Conference on Theory and Practice of Electronic Governance (ICEGOV 2012)*, *ACM International Conference Proceeding Series (ICPS)*, Albany, NY, USA, pp.475–476.
- Filho, W.P. and Ribeiro, C. (2014) 'Obtaining strong identifiers through attribute aggregation', *Proceedings of the 8th International Conference on Emerging Security Information, Systems and Technologies (SECURWARE 2014)*, Lisbon, Portugal, pp.96–100.
- Freire, M., Fortes, N. and Barbosa, J. (2014) 'Decisive factors for the adoption of technology in e-government platforms', *Proceedings of the 9th Iberian Conference on Information Systems and Technologies (CISTI 2014)*, Barcelona, Spain.
- Gaaloul, K., Guerreiro, S. and Proper, H.A. (2014) 'Modeling access control transactions in enterprise architecture', *Proceedings of the 16th IEEE Conference on Business Informatics (CBI 2014)*, Vol. 1, pp.127–134.
- Gomes, H., Zúquete, A. and Dias, G.P. (2011) 'Citizen controlled exchange of information in e-government', *Proceedings of the 7th International Conference on Web Information Systems and Technologies (WEBIST 2011)*, Noordwijkerhout, Netherlands, pp.494–499.
- Gomes, H., Zúquete, A. and Dias, G.P. (2012) 'Citizen-side handling of life event services', *Proceedings of the 8th International Conference on Web Information Systems and Technologies (WEBIST 2012)*, Porto, Portugal, pp.565–570.
- Gomes, R. and Ribeiro, J. (2009) 'Use of web services in e-government information systems – a case study', *Proceedings of the 2009 International Conference on Information Management and Engineering (ICIME 2009)*, Kuala Lumpur, Malaysia, pp.475–480.
- Irani, Z., Lee, H., Weerakkody, V., Kamal, M., Topham, S., Simpson, G., Balci, A., Medeni, T.D., Gábor, A., Kö, A., Küçükpehlivan, A., Dabanli, A., Sağiroğlu, C., Saygin, Y., Nergiz, E., Hintoglu, A., Campos, L.M., Correia, P., Luis, J.P.S., Rebahi, Y., Onofrei, A.A., Iancu, M., Pop, E. and Barbos, M. (2010) 'Ubiquitous participation platform for pOLicy makings (UbiPOL): a research note', *International Journal of Electronic Government Research*, Vol. 6, No. 1, pp.78–106.

- Ismayilova, N. (2014) 'A bibliometric analysis of innovation research', *Elektron dövlət quruculuğu problemləri I Respublika elmi-praktiki konfransı*, pp.93–95, [http://ict.az/uploads/konfrans/GOOGLE\\_SCHOLAR\\_e-gov/28N.Ismayilova.pdf](http://ict.az/uploads/konfrans/GOOGLE_SCHOLAR_e-gov/28N.Ismayilova.pdf) (Accessed 4 January, 2016)
- Janssen, M., Estevez, E. and Janowski, T. (2014) 'Interoperability in big, open, and linked data-organizational maturity, capabilities, and data portfolios', *Computer*, Vol. 47, No. 10, pp.44–49.
- Joseph, R.C. (2013) 'A structured analysis of e-government studies: trends and opportunities', *Government Information Quarterly*, Vol. 30, No. 4, pp.435–440.
- Katre, D., Campos, P., Clemmensen, T., Orngreen, R. and Pejtersen, A.M. (2011) 'Human work interaction design for e-government and public information systems', *Proceedings of the 13th IFIP TC 13 International Conference on Human-Computer Interaction (INTERACT 2011), Lecture Notes in Computer Science Series (LNCS)*, Springer, Lisbon, Portugal, Vol. 6949, pp.730–731.
- Lapão, L.V., Santos, R.S., Góis, M. and Silva, P.D. (2007) 'Healthcare internet marketing: developing a communication strategy for a broad healthcare network', *Proceedings of the 1st International Conference on Theory and Practice of Electronic Governance (ICEGOV 2007), ACM International Conference Proceeding Series (ICPS)*, Macao, China, Vol. 232, pp.291–295.
- Lourenço, R.P., Rolas, H. and Jorge, S. (2014) 'Public administration online transparency: defining the information items to disclose from a citizens' perspective', *Proceedings of the 9th Iberian Conference on Information Systems and Technologies (CISTI 2014)*, Barcelona, Spain.
- Luján-Mora, S. and Masri, F. (2012) 'Evaluation of web accessibility: a combined method', *Information Systems Research and Exploring Social Artifacts: Approaches and Methodologies*, IGI Global, pp.1012–1029.
- Machado, R.J., Fernandes, J.M., Monteiro, P. and Rodrigues, H. (2005) 'Transformation of UML models for service-oriented software architectures', *Proceedings of the 12th IEEE International Conference and Workshops on the Engineering of Computer-Based Systems (ECS 2005)*, Greenbelt, MD, USA, pp.173–182.
- Maciel, C., Pereira, V.C., Roque, L. and Garcia, A.C.B. (2009a) 'Applying the discourse theory to the moderator's interferences in web debates', *Proceedings of the 11th International Conference on Enterprise Information Systems (ICEIS 2009), Lecture Notes in Business Information Processing Series (LNBIP)*, Vol. 24, pp.882–893.
- Maciel, C., Pereira, V.C., Roque, L. and Garcia, A.C.B. (2009b) 'Identifying discourse mistakes in web debates: moderation in the DCC', *Proceedings of the 24th Annual ACM Symposium on Applied Computing*, Honolulu, HI, USA, pp.690–691.
- Maciel, C., Roque, L. and Garcia, A.C.B. (2010) 'Interaction and communication resources in collaborative e-democratic environments: the democratic citizenship community', *Information Polity*, Vol. 15, Nos. 1–2, pp.73–88.
- Marques, F., Dias, G.P. and Zúquete, A. (2011) 'A general interoperability architecture for e-government based on agents and web services', *Proceedings of the 6th Iberian Conference on Information Systems and Technologies (CISTI 2011)*, Chaves, Portugal.
- Marques, F., Dias, G.P. and Zúquete, A. (2012) 'Security model for the dynamic composition of workflows in architectures of e-government', *RISTI – Revista Iberica de Sistemas e Tecnologias de Informacao*, Vol. 9, No. 1, pp.15–26.
- Marques, F., Dias, G.P. and Zúquete, A. (2013) 'Agent-based interoperability for e-government', *Proceedings of the 10th International Symposium on Distributed Computing and Artificial Intelligence (DCAI 2013), Advances in Intelligent Systems and Computing Series*, Springer, Vol. 217, pp.561–568.
- Montargil, F. (2009) 'E-government and government transformation: technical interactivity, political influence and citizen return', in Nixon, P.G., Koutrakou, V.N. and Rawal, R. (Eds.): *Understanding E-Government in Europe: Issues and Challenges*, Routledge, pp.61–37.

- OECD (2008) *Making Life Easy for Citizens and Businesses in Portugal: Administrative Simplification and E-Government*, OECD Publications, Paris, <http://www.oecd.org/mena/governance/42600869.pdf> (Accessed 30 December, 2015).
- Olmstead, P.M., Peinel, G., Tilsner, D., Abramowicz, W., Bassara, A., Filipowska, A., Wiśniewski, M. and Zebrowski, P. (2007) 'Usability driven open platform for mobile government (USE-ME.GOV)', in Kushchu, I. (Ed.): *Mobile Government: An Emerging Direction in E-Government*, IGI Global, pp.30–59.
- Pascoe, J., Rodrigues, H. and Ariza, C. (2006) 'An investigation into a universal context model to support context-aware applications', *Proceedings of the OTM 2006 Workshops, Lecture Notes in Computer Science Series (LNCS)*, Vol. 4278, pp.1884–1893.
- Pedrosa, D., Varajão, J., Trigo, A. and Silva, P.S. (2013) 'E-government simulation tool for accounting education: personal income tax simulator', in Cruz-Cunha, M.M., Varajão, J.E. and Trigo, A. (Eds.): *Sociotechnical Enterprise Information Systems Design and Integration*, IGI Global, pp.233–249.
- Pinto, D. and Aveiro, D. (2014) 'An e-government project case study: interview based DEMO axioms' benefits validation', *Proceedings of the 6th International Conference on Knowledge Engineering and Ontology Development (KEOD 2014)*, Rome, Italy, pp.138–149.
- Polónia, D.F., Dias, G.P. and Rafael, J.A. (2014) 'Strategic planning in the implementation of an e-government regional system: The Porto Santo case', *Proceedings of the 9th Iberian Conference on Information Systems and Technologies, (CISTI 2014)*, Barcelona, Spain.
- Przebylovicz, E., Coelho, T.R. and Cunha, M.A. (2014) 'The development of studies on electronic government in Brazil: a bibliometric and sociometric study', *Proceedings of the 2014 International Conference on Information Resources Management (Conf-IRM 2014)*, Ho Chi Minh City, Vietnam.
- Ribeiro, I. (2011) 'Older people and e-government in Portugal', *Proceedings of the 6th Iberian Conference on Information Systems and Technologies (CISTI 2011)*, Chaves, Portugal.
- Rocha, Á. and Sá, F. (2014) 'Planning the information architecture in a local public administration organization', *Information Development*, Vol. 30, No. 3, pp.223–234.
- Rodousakis, N. and dos Santos, A.M. (2008) 'The development of inclusive e-Government in Austria and Portugal: a comparison of two success stories', *Innovation*, Vol. 21, No. 4, pp.283–316.
- Rodrigues, M., Dias, G.P. and Teixeira, A. (2010a) 'Automatic extraction and representation of geographic entities in e-government', *Proceedings of the 5th Iberian Conference on Information Systems and Technologies (CISTI 2010)*, Santiago de Compostela, Spain.
- Rodrigues, M., Dias, G.P. and Teixeira, A. (2010b) 'Human language technologies for e-gov', *Proceedings of the 6th International Conference on Web Information Systems and Technology (WEBIST 2010)*, Valencia, Spain, Vol. 2, pp.400–403.
- Rosa, J., Teixeira, C. and Sousa Pinto, J. (2013) 'Risk factors in e-justice information systems', *Government Information Quarterly*, Vol. 30, No. 3, pp.241–256.
- Sá, F. and Rocha, A. (2012) 'Definição da arquitetura de informação em organismo da administração pública local', *RISTI – Revista Iberica de Sistemas e Tecnologias de Informacao*, Vol. 10, No. 1, pp.51–64.
- Sá, F. and Rocha, Á. (2013) 'Information architectures definition – a case study in a Portuguese local public administration organization', in Rocha, A., Correia, A.M., Wilson, T. and Stroetmann, K.A. (Eds.): *Advances in Information Systems and Technologies, Advances in Intelligent Systems and Computing Series (AISC)*, Springer, pp.399–410.
- Sá, F., Rocha, A. and Cota, M.P. (2014a) 'Quality models for online e-Government services', *Proceedings of the 9th Iberian Conference on Information Systems and Technologies (CISTI 2014)*, Barcelona, Spain.
- Sá, F., Rocha, A. and Cota, M.P. (2014b) 'Quality models of e-government online services: towards a local focus', *Proceedings of the 14th IEEE International Conference on Computer and Information Technology (CIT 2014)*, Xi'an, Shaanxi, China, pp.393–398.

- Santos, P., Melo, A.I. and Dias, G.P. (2013) 'Administrative modernisation and e-government: the case of Águeda', *Proceedings of the 8th Iberian Conference on Information Systems and Technologies (CISTI 2013)*, Lisbon, Portugal.
- Sanz, A.C., Neves, J.C. and Valente, J.N. (2010) 'A conceptual model of e-Local Government', *Proceedings of the 5th Iberian Conference on Information Systems and Technologies (CISTI 2010)*, Santiago de Compostela, Spain.
- Silva, A.R., Marques, C.G., Coutinho, M. and Mendes, J.R. (2012) 'Extending professional active life – involvement of local government', *Proceedings of the 7th Iberian Conference on Information Systems and Technologies, (CISTI 2012)*, Madrid, Spain.
- Silva, E., Faias, J. and Lopes, C.T. (2006) 'Virtual barriers in e-government in Portugal', *Proceedings of the 7th Iberian Conference on Information Systems and Technologies (CISTI 2006)*, Vol. 2, pp.805–820.
- Silva, P.S., Trigo, A. and Varajão, J. (2012) 'Using simulation for enhanced accounting learning: a case study', *International Journal of Distance Education Technologies*, Vol. 10, No. 4, pp.26–43.
- Soares, D. and Amaral, L. (2011) 'Information systems interoperability in public administration: identifying the major acting forces through a Delphi study', *Journal of Theoretical and Applied Electronic Commerce Research*, Vol. 6, No. 1, pp.61–94.
- Tavares, J. and Oliveira, T. (2014) 'Electronic health record portal adoption by health care consumers: proposal of a new adoption model', *Proceedings of the 10th International Conference on Web Information Systems and Technologies (WEBIST 2014)*, Vol. 1, pp.387–393.
- Tavares, L.V. and Silva, P. (2006) 'An electronic social network to market topics of public interest: Net@INA', *Proceedings of the 7th Annual International Conference on Digital Government Research, ACM International Conference Proceeding Series (ICPS)*, Vol. 151, pp.458–459.
- Tavares, M. (2008) 'The use of cybergenres as a communication and knowledge management process in local government', *Proceedings of the 26th ACM International Conference on Design of Communication (SIGDOC 2008)*, Lisbon, Portugal, pp.283–284.
- Teixeira, R., Afonso, F., Oliveira, B., Portela, F. and Santos, M.F. (2014) 'Business intelligence to improve the quality of local government services: case-study in a local government town hall', *Proceedings of the 6th International Conference on Knowledge Management and Information Sharing (KMIS 2014)*, Rome, Italy, pp.153–160.
- Teodoro, N. and Serrão, C. (2010) 'Web applications security assessment in the Portuguese world wide web panorama', *Communications in Computer and Information Science*, Vol. 72, pp.63–73.
- Tinholt, D., Colclough, G., Tol, T., van der Linden, N., Cattaneo, G., Lifonti, R., Aguzzi, S. and Jacquet, L. (2014) *Delivering on the European Advantage?*, European Commission, [http://ec.europa.eu/newsroom/dae/document.cfm?doc\\_id=5811](http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=5811) (Accessed 5 January, 2016).
- Tsaravas, C. and Themistocleous, M. (2011) 'Cloud computing and e-government: a literature review', *Proceedings of the 8th European, Mediterranean and Middle Eastern Conference on Information Systems (EMCIS 2011)*, Athens, Greece, pp.154–164.
- UN (2014) *United Nations E-Government Survey 2014*, Department of Economic and Social Affairs, New York, [http://unpan3.un.org/egovkb/Portals/egovkb/Documents/un/2014-Survey/E-Gov\\_Complete\\_Survey-2014.pdf](http://unpan3.un.org/egovkb/Portals/egovkb/Documents/un/2014-Survey/E-Gov_Complete_Survey-2014.pdf) (Accessed 5 January, 2016).
- Vieira, R., Borbinha, J., Valdez, F. and Vasconcelos, A. (2011) 'A reference architecture for records management', *Proceedings of the 12th Annual International Digital Government Research Conference, ACM International Conference Proceeding Series (ICPS)*, College Park, MD, USA, pp.339–340.

## Notes

<sup>1</sup>The *h*-index, or Hirsch Index, of a researcher is the number of papers co-authored by the researcher with at least *h* citations each (Hirsch, 2007).

<sup>2</sup>Quartiles calculated using SJR SCImago Journal Rank. Titles in the first quartile (*Q1*) are amongst the 25% best ranked journals in a given subject area; titles in second quartile (*Q2*) are amongst the 50% best ranked journals but below the 25% best ranked journals, etc. The SJR indicator measures the scientific influence of the average paper in a journal. It expresses how central to the global scientific discussion an average paper of the journal is by using the Scopus® database as a source for citation data. Because a journal can be classified in different quartiles for different subject areas, the best quartile of each journal was used in this study.